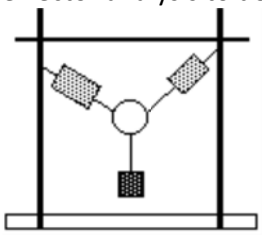
Physics Name:

Lab – Hanging Signs

OBJECTIVE:

To build a simple mechanical system that represents a hanging sign, and to use vector analysis to determine the weight of the sign.



MATERIALS:

Mechanical support stand	2.5 - 5.0 N spring scales
mass hanger	slotted mass set
3 S-hooks/right angle clamps	key ring
protractor	ruler

PROCEDURE:

Part 1 - Measuring the Forces

1. Connect two spring scales and weight hanger as pictured above (to simulate a hanging sign). Be sure to keep the scales at different angles and try to keep the needle on the scales about 2/3 of the full extension (Don't "max out" the scales as this can damage them!)

2. Place 250g on the weight hanger (remember the hanger itself has a mass of ???). Read the force indicated on spring scale A and record the value as F_a on data table. Read the force indicated on spring scale B, and record the value as F_b.

3. Use a protractor to measure the angle between each scale and the vertical (you may wish to hang a plumb line to give you a reference to measure from). Record these as <A and <B.

4. Measure the mass of the "hanging sign" and record: _____ (g)

*Be sure to indicate precision of the tools used to take measurements. This will guide your use of significant digits as you do calculations.

DATA:

Vector	Force (N)	Angle (°)	x-comp (N)	y-comp (N)
A				
B				

Actual Force (N): _____

Method	Resultant Magnitude (N)	Resultant Angle (°)	% Error
Scale Diagrams			
Component Method			

ANALYSIS

1. Draw a scale diagram of the vectors representing the measurements and directions of the forces recorded from the scales. Indicate the direction and the scale (ie. 1cm = 1.5 N) of your diagram.

2. Use the "scale diagram" or "graphical" method to add the two spring vectors (head-to-tail). Determine the resultant force. This force should equal the force of the hanging weight. Why?

3. Redo steps 1 and 2 using the component method to add the vectors. Record your results in table #2.

4. Determine the actual force (weight) of the mass on the hanger. Use this to find your percent error. Record the % error in magnitude as well as the ° error in angle.

CALCULATIONS:

Show your analysis using the graphical and the component methods as well as your calculation of % error.

QUESTIONS:

1. Look up "equilibrium" in your text or online. Describe what it means for a "system to be in equilibrium."

2. Ideally, what would the net force be if you add the resultant of the two spring scales to the force of the hanger (sign)? Explain.

3. If a person pulls a wagon with a force of 300.0 N at an angle of 34.0° above the ground, what are the components of that force?

4. How fast is an airplane going w.r.t. the ground if its air speed is 425 mph (east) and it encounters a wind blowing 20.0° north of west at 38.1 mph (draw a picture and solve)?

5. Which method is more accurate? You may need to survey classmates in other groups for a good sample set. Discuss the reasoning behind your answer.

ERROR ANALYSIS:

What was your % error? What possible sources of error exist in this experiment? How do they affect your results?

CONCLUSION:

What did you do in this lab? What results did you find? What generalizations can you make?